REMARKS

The enclosed is responsive to the Office Action mailed on September 20, 2007. At the time the Examiner mailed the Office Action claims 1-10 were pending, and claims 11-27 were cancelled. By way of the present response claim 1 has been amended to more particularly point out and distinctly claim the subject matter which Applicants regard as the invention, and claims 28-31 have been added. As such, claims 1-10 and 28-31 are now pending. Applicants respectfully request reconsideration of the present application and the allowance of all claims now presented.

Claim Rejections - 35 U.S.C. §112, first paragraph

The Examiner has rejected claims 1-10 under 35 U.S.C. § 112, first paragraph, as failing to comply with the enablement requirement. The Examiner has rejected claims 1-10 under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement.

In particular, the Examiner states that "undue experimentation" would be necessary to practice the invention and requests that Applicants provide evidence in affidavit form (37 CFR 1.132) that details how making a "connector molecule" like $C_{19}S_6H_{24}$ is known in the art, and how one of ordinary skill in the art would take the connector molecule and connect it to the nanotube.

In response to the Examiner's request, Applicants have provided the requested evidence in affidavit form (37 CFR 1.132). Therefore, by way of present response, a discussion of the factual evidence and opinions provided in the 1.132 affidavit is provided herein, which is followed by a discussion applying the factual evidence and opinions to the factors for undue experimentation as presented in *In re Wands*, 858 F.2d 731, 737, 8 USPQ2d 1400, 1404 (Fed. Cir. 1988).

I. 37 CFR 1.132 affidavit

In response to the Examiner's request, Applicants have provided the requested evidence in affidavit form (37 CFR 1.132). A discussion of the facts presented in the affidavit as they relate to the two specific requests by the Examiner follows:

a) Making a "connector molecule"

The connector molecule and three-dimensional nanotube structures taught and claimed in claims 1-10 were conceptualized and devised utilizing HyperChem, a well-known molecular modeling software at the time of the invention. As stated in the attached affidavit, computer-aided molecular design was widely used in industry at the time of the invention as a method for modeling new molecule structures and predicting structure-behavior relationships of molecules. Exhibit A attached herewith provides a list of references demonstrating the use of HyperChem in 2004. Appendix A provides that HyperChem was widely used in industry at the time of the invention as a method for modeling new molecule structures and predicting structure-behavior relationships of molecules.

Applicants respectfully point the Examiner's attention to *Johnsamuel et al. "A Convenient Method for the Computer-Aided Molecular Design of Carborane Containing Compounds,"* in which computer-aided molecular design of carborane clusters resembled closely the geometries of carborane clusters prepared by theoretical and experimental methods. As stated on page 20, col. 2, lines 3-7, HyperChem provided geometries that correlated sufficiently with those obtained by experimental electron diffraction data. Accordingly, Applicants respectfully submit that the computer-aided molecular design of Applicants' connector molecules generated with HyperChem would correlate sufficiently with those molecules synthesized in the laboratory.

Furthermore, as shown by the additional references in Exhibit A, computer-aided molecular design has been used to predict structure-behavior relationships of molecules such as thermal behavior, gas chromatographic retention indices, and corrosion inhibition.

Therefore, Applicants respectfully submit that making a "connector molecule" like $C_{19}S_6H_{24}$ would not require undue experimentation by one of ordinary skill in the art familiar with analytical chemistry and computer-aided molecular design software such as HyperChem.

b) Connecting the "connector molecule" to the nanotube

As stated in the attached affidavit, functionalization of carbon nanotubes was widely studied at the time of the invention. Appendix B attached herewith provides a list of references demonstrating the attachment of functional groups to carbon nanotubes. Exhibit B demonstrates that several methods of functionalizing carbon nanotubes were widely available at the time of the invention.

Therefore, Applicants respectfully submit that with the number of known methods of functionalizing carbon nanotubes at the time of the invention, that one of ordinary skill in the art would not require undue experimentation to take the connector molecule and connect it to the nanotube as claimed by Applicant in claims 1-10.

II. Undue Experimentation Factors

In examining the claims in light of the supporting disclosure, the Federal Circuit has provided a non-exclusive list of factors to consider in determining whether a disclosure is enabling. *See generally In re Wands*, 858 F.2d 731, 737, 8 USPQ2d 1400, 1404 (Fed. Cir. 1988). Applicants have considered all the factors in light of all the claims rejected.

a) The state of the prior art and level of one of ordinary skill

As admitted by the Examiner in the office action mailed on 3/22/2007, "A well developed body of prior art exists in the fields of nanotechnology and fullurene chemistry. **One of ordinary skill in the art would presumably be familiar with carbon nanotubes, their production, and assorted functionalization/derivitization reactions associated with carbon nanotubes**." Applicant agrees with the Examiner, and provides additional support in Exhibit B which demonstrates that several methods of functionalizing carbon nanotubes were widely available at the time of the invention.

Furthermore, Applicants respectfully submit that the computer-aided molecular design of molecules has been shown to correlate sufficiently with those molecules synthesized in the laboratory. Additional support is provided in Exhibit A.

b) The level of predictability in the art

As described above, a number of methods of functionalizing carbon nanotubes were known in the art. Furthermore, computer-aided molecular design has proven to correlate sufficiently with molecules synthesized in the laboratory.

Accordingly, Applicants respectfully submit that the level of predictability in the art is significant.

c) The amount of direction provided by the inventor

It is Applicant's understanding that the Examiner's primary concern is the limited amount of discussion relating to reagents, temperature, pressure, etc. when forming the "connector molecule" and bonding the "connector molecule" with the

"nanotube segments." In particular, the Examiner states that "All that was discussed was which atom was connected to what."

However, Applicant respectfully submits that the models provided in the specification, including which atoms connect to each other, was achieved utilizing an industry accepted molecular design software. Therefore, Applicants respectfully submit that one of ordinary skill in the art familiar with analytical chemistry and computer-aided molecular design software such as HyperChem, would understand the amount of direction and models provided by Applicants as significant.

d) The existence of working samples

No SEM images, or x-ray diffraction data was provided by Applicants. However, as discussed above, Applicants respectfully submit that computer-aided molecular design has been shown to closely resemble geometries of molecules prepared by theoretical and experimental methods.

e) Quantity of experimentation needed to make or use the invention based on the content of the disclosure

As discussed above, Applicants respectfully submit that computer-aided molecular design has been shown to closely resemble geometries of molecules prepared by theoretical and experimental methods. Furthermore, Applicants submit that because functionalization reactions are known in the art, and that computer-aided molecular design has introduced a level of predictability into analytical chemistry techniques that an undue amount of experimentation would not be needed to make or use the invention.

For these reasons, Applicants respectfully submit that claims 1-10 comply with the enablement and written description requirements of 35 U.S.C. § 112, first paragraph, and request withdrawal of the rejections.

Claim Rejections - 35 U.S.C. §102

The Examiner has rejected claims 1-2 and 6-10 under 35 U.S.C. § 102(e) as being anticipated by *Smalley et al.* (U.S. Patent No. 6,790,425). Applicants respectfully submit that the invention as claimed in claims 1-2 and 6-10 is not anticipated by *Smalley*.

Applicants teach and claim a method for producing three-dimensional nanotube structures, where a number of nanotubes are opened to create open-ended nanotube segments, and a corresponding number of connector molecules are brought into contact with the nanotube segments. These connector molecules possess first bonding sites that bond with one end of the nanotube segments, and a second bonding site that bonds with a corresponding bonding site of a plurality of other connector molecules. That is, Applicants claim using connector molecules to bond one end of the connector molecule to one end of a nanotube segment, and using the other end of the connector molecule to bond to one end of the two or more connector molecules, where the other end of the two or more connector molecules are bonded to one end of a nanotube segment. In this way, one nanotube can be coupled to two or more other nanotubes to form a three-dimensional nanotube structure.

Applicants respectfully disagree with the rejection because *Smalley* does not disclose each and every element of the Invention as claimed in claim 1. Specifically, *Smalley* does not teach bonding one nanotube segment to two or more nanotube segments (through the use of connector molecules).

Applicants respectfully submit that the Examiner has mistakenly equated the "connector molecules" (Claim 1) in the Application with the "transitional metal catalyst atoms or particles" (*Smalley* 13, 23) disclosed in *Smalley*. In *Smalley*, the "transitional metal catalyst atoms or particles" are employed to "re-start the growth of the exposed tube ends. In this way a larger, macroscopic, ordered assembly of SWNT is grown" (*Smalley* 13, 29-31). These "transitional metal catalyst atoms or particles" are not similar to the "connector molecules" claimed by Applicants due to the difference in function. The catalyst atoms of *Smalley* are used to re-start the growth of SWNT in a linear manner. In fact, these catalyst atoms do not actually connect nanotube segments. These catalyst atoms are used to allow the growth of SWNT when exposed to carbon feed stock at an appropriate temperature and pressure. Notwithstanding the growth process, these catalyst atoms only bond to one other nanotube segment, and do not bond to two or more nanotube segments. Because of its function, these catalyst atoms cannot be used to bond to two or more nanotube segments to form a three-dimensional nanotube structure in the manner claimed by the Application. In contrast, the "connector molecule" claimed by Applicants provides for "bonding with one end of the nanotube segments and... bonding with a corresponding bonding site of a plurality of other connector molecules" (Claim 1). These bonds give rise to the formation of the claimed three-dimensional nanotube structure.

For these reasons, Applicants respectfully submit that claim 1 is not anticipated by *Smalley* under 35 U.S.C. §102(e). Given that claims 2, and 6-10 depend directly or indirectly from claim 1, Applicants respectfully submit that claims 2, and 6-10 are likewise not anticipated by *Smalley* under 35 U.S.C. §102(e). Accordingly, Applicants respectfully request the withdrawal of the rejection of claims 1-2, and 6-10.

New Claims

New claims 28-31 claim a method of forming three-dimensional nanotube structures. It is Applicants' understanding that these limitations are not taught by the prior art of record.